

Appl. No. : 08/870,836  
Filed : June 6, 1997

Discussion of the Claim Rejection under 35 U.S.C. § 102(e)

Claims 18-22 were rejected under 35 U.S.C. § 102(e) as being anticipated by Zabih et al. ("Zabih"), U.S. Patent No. 5,767,922. Zabih describes "detecting scene breaks in a sequence of video frames providing a moving picture. Entering and exiting edge pixels in each of a plurality of successive video frames are counted, and an edge change fraction for each of the successive video frames is derived therefrom. Peaks which are detected in the edge change fractions are indicative of scene breaks." The scene breaks include cuts, fades, dissolves and wipes.

Applicant's claimed invention is directed to a computerized method of extracting a key frame from a video having a plurality of frames. In contrast, Zabih identifies scene breaks which are typically five to ten or more frames in length. See, for example, the scene break peaks identified in Figure 7, each of which include multiple frames. Zabih does not describe how the system identifies a key frame - is it one of the frames from the scene break, is it the middle frame from a shot identified by a pair of successive scene breaks, is more than one frame selected from a shot, etc.

Applicant's claimed invention performs the key frame extraction by comparing a current frame to a reference frame. Some of the claims have been amended to clarify that a new current frame is selected if the structure difference measure does not exceed the structure threshold. Acts c) and d) are repeated until a key frame is identified. The reference frame stays fixed until the key frame is identified (Claim 19). In contrast, Zabih performs calculations on successive frames, as stated at Column 4, lines 49-52: "In order to detect scene breaks efficiently and accurately, in accordance with the present invention an edge change fraction is obtained in each of a plurality of successive video frames...". Applicant's claimed invention does not calculate an edge change fraction between successive frames, as performed by Zabih.

Since Zabih does not describe a computerized method of extracting a key frame from a video where the reference frame is fixed until a key frame is identified, Applicant submits that Zabih is overcome as a reference for Claim 18. Since Claims 19-22 are dependent on independent Claim 18, pursuant to 35 U.S.C. § 112, ¶4, they incorporate by reference all the limitations of the claim to which they refer. Therefore, the rejection of the dependent Claims 19-22 has also been overcome. Therefore, in view of the above, it is submitted that Claims 18-22 are clearly distinguished from the cited art and are patentable.

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Discussion of the Claim Rejection under 35 U.S.C. § 103(a)

Claims 1-17 and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Zabih, U.S. Patent No. 5,767,922, in view of the submitted Dissertation by Arun Hampapur, University of Michigan, 1995 ("Hampapur"). The Examiner cited pages 97-102 of the dissertation, and specifically page 97, lines 11-18.

Applicant's claimed invention performs the key frame extraction by comparing a current frame to a reference frame. Some of the claims have been amended to clarify that a new current frame is selected if the chromatic difference measure does not exceed the chromatic threshold and the structure difference measure does not exceed the structure threshold. Acts c) through e) are repeated until a key frame is identified. The reference frame stays fixed until the key frame is identified (Claims 2, 9). In contrast, Zabih performs calculations on successive frames, as stated at Column 4, lines 49-52. Applicant's claimed invention does not calculate an edge change fraction between successive frames, as performed by Zabih.

The Examiner stated that it would be obvious "to incorporate the Hampapur chromatic scaling teaching of the dissertation into the Zabih method in order to have dual measures, because no method works perfectly by itself (Zabih: column 16, lines 30-45)." The cited text is as follows:

Our edge detection method does not handle rapid changes in overall scene brightness, or scenes which are very dark or very bright. Rapid changes in overall scene brightness can cause a false positive. Since a thresholded gradient-based edge detector is dependent on the relative contrast of regions in the image, large-scale scalings in image brightness will disturb the edge density of the scene. This effect sometimes occurs in scenes due to camera auto gain.

Scene break detectors of the prior art based on intensity histogramming will also generate false positives when the overall scene brightness changes dramatically. Although the intensities change dramatically, the underlying edge structure of the image does not change. A more robust edge detection scheme may enable these events to be handled.

Applicant respectfully disagrees and submits that the cited passage teaches away from use of an intensity histogram and, instead, promotes a more robust edge detection scheme. Zabih does not describe how dual measures, dual thresholds and the sequence of applying the dual measures and the dual thresholds would be implemented.

Starting at column 12, line 60 through column 16, the Zabih reference tests its method of determining edge change fractions on sample video sequences against those of other methods (e.g.,

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Nagasaka, Otsuji, Zhang, Hampapur). See the three sets of test results in conjunction with Figures 14-16, Figures 17-18, and Figures 19-20. Column 14, lines 34-38 describe an instance of a shortcoming of the Hampapur method, for example. The description of the contrasted test results is also used by the Examiner to reject dependent Claims 7 and 14-17. Regarding Claims 7 and 14, the Examiner stated that "the Zabih method, now incorporating the Hampapur chromatic scaling method as outlined in the dissertation, discloses that the second difference measure is only performed if the first difference measure exceeds the first threshold (Zabih: column 15, lines 1-20)". Applicant respectfully disagrees and submits that the cited text merely describes test results for two separate methods. Regarding Claims 15-16, the Examiner cited column 15, lines 30-68. Applicant respectfully disagrees and submits that the cited text describes test results for Zabih's method of determining edge change fractions without motion compensation and then with motion compensation enabled. The motion compensation is not a difference measure, but is done prior to computing the edge change fractions to digitally align successive frames. Regarding Claim 17, the text cited by the Examiner further describes motion compensation, which again is not a difference measure.

Note that the rejection of Claim 10 on page 6 of the Office Action dated March 9, 2000, appears to be in error. Claim 10 recites that the "first difference measure is orthogonal to the second difference measure", and is not similar to Claim 3.

Since Zabih does not describe a computerized method of extracting a key frame from a video where the reference frame is fixed until a key frame is identified, Applicant submits that Zabih is overcome as a reference for Claims 1, 8 and 23. Since Claims 2-7 and 9-17 are dependent on independent Claims 1 and 8, respectively, pursuant to 35 U.S.C. § 112, ¶4, they incorporate by reference all the limitations of the claim to which they refer. Therefore, the rejection of the dependent Claims 2-7 and 9-17 has also been overcome. Therefore, in view of the above, it is submitted that Claims 1-17 and 23 are clearly distinguished from the cited art and are patentable.

#### New Claim

New Claim 24 is supported by Figure 5 and the corresponding text at pages 9-11 of the patent specification.

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Conclusion

By this amendment, Applicant has added a new claim and amended the claims. In view of the foregoing amendments and remarks, Applicant respectfully submits that Claims 1-24 of the above-identified application are in condition for allowance. However, if the Examiner finds any further impediment to allowing all claims that can be resolved by telephone, the Examiner is respectfully requested to call the undersigned.

Respectfully submitted,

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Dated: 7/14/2000

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